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<110> DRAKE, Caroline Rachel
      PAINE, Jacqueline Ann Mary
      SHIPTON, Catherine Ann

<120> ENHANCED ACCUMULATION OF CAROTENOIDS IN PLANTS

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<151> 2004-03-22

<150> US60/457,053
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gttgctggaa ctgtcgggtt aatgagcgta cctgtgatgg gcatcgcaac cgagtctaaa     780

gcaacaactg aaagcgtata cagtgctgcc ttggctctgg gaattgcgaa ccaactcacg     840

aacatactcc gggatgttgg agaggatgct agaagaggaa ggatatattt accacaagat     900

gagcttgcac aggcagggct ctctgatgag gacatcttca aaggggtcgt cacgaaccgg     960

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agaggggtaa atgagctctc acaggctagc agatggccag tatgggcttc cctgttgttg    1080

tacaggcaga tcctggatga gatcgaagcc aacgactaca acaacttcac gaagagggcg    1140

tatgttggta aagggaagaa gttgctagca cttcctgtgg catatggaaa atcgctactg    1200

ctcccatgtt cattgagaaa tggccagacc tag                                 1233
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<210> 12

<211> 1233

<212> DNA

<213> Zea mays

<400> 12
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caccagggga ctctccagtg ctccaccctg ctcaagacga agaggccggc ggcgcgccgg     120

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gtctacgacg tcgtgctcaa gcaggccgca ttgctcaaac gccagctgcg cacgccggtc     300

ctcgacgcca ggccccagga catggacatg ccacgcaacg ggctcaagga agcctacgac     360

cgctgcggcg agatctgtga ggagtatgcc aagacgtttt acctcggaac tatgttgatg     420
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acagaggagc ggcgccgcgc catatggggcc atctatgtgt ggtgtaggag gacagatgag      480

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gttgctggaa ctgtcgggtt aatgagcgta ccagtgatgg gcatcgcatc cgagtctaaa      780

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agaggggtaa ctgagctctc acaggctagc agatggccag tatgggcttc cctgttgttg     1080

tacaggcaga tcctggatga gatcgaagcc aacgactaca caacttcac gaagagggcg      1140

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ctcccatgtt cattgagaaa tggccagacc tag                                 1233
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<210> 13

<211> 1263

<212> DNA

<213> Oryza sp.

<400> 13
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ccaagaaacg gcctcaagca ggcctatcat cgctgcggag agatctgcga ggagtatgcc      420

aagacctttt accttggaac tatgctcatg acggaggacc gacggcgcgc catatgggcc      480

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acaccgtcag ccctggaccg gtgggagaag aggcttgatg atctcttcac cggacgcccc      600

tacgacatgc ttgatgctgc actttctgat accatctcca gtttcctat agatattcag       660

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ttcgacgagc tctacatgta ctgctactat gttgctggaa ctgtggggct aatgagtgtt    780

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ttggctctcg gcattgcaaa ccagctcaca aatatactcc gtgacgttgg agaggacgcg    900

agaagaggga ggatatattt accacaagat gaacttgcag aggcagggct ctctgatgag    960

gacatcttca atggcgttgt gactaacaaa tggagaagct tcatgaagag acagatcaag   1020

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cttccagttg catatggtag atcattgctg atgccctact cactgagaaa tagccagaag   1260

tag                                                                 1263
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<210> 14

<211> 420

<212> PRT

<213> Oryza sp.

<400> 14

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1               5               10              15

Asp Ala Leu Ala Arg Asp Ala Ala Ala Val Gln His Val Cys Ser Ser
            20              25              30

Tyr Leu Pro Asn Asn Lys Glu Lys Lys Arg Arg Trp Ile Leu Cys Ser
            35              40              45

Leu Lys Tyr Ala Cys Leu Gly Val Asp Pro Ala Pro Gly Glu Ile Ala
        50              55              60

Arg Thr Ser Pro Val Tyr Ser Ser Leu Thr Val Thr Pro Ala Gly Glu
65              70              75              80

Ala Val Ile Ser Ser Glu Gln Lys Val Tyr Asp Val Val Leu Lys Gln
                85              90              95

Ala Ala Leu Leu Lys Arg His Leu Arg Pro Gln Pro His Thr Ile Pro
            100             105             110

Ile Val Pro Lys Asp Leu Asp Leu Pro Arg Asn Gly Leu Lys Gln Ala
                        Page 33
```

Tyr His Arg Cys Gly Glu Ile Cys Glu Glu Tyr Ala Lys Thr Phe Tyr
  130   135   140

Leu Gly Thr Met Leu Met Thr Glu Asp Arg Arg Arg Ala Ile Trp Ala
145   150   155   160

Ile Tyr Val Trp Cys Arg Arg Thr Asp Glu Leu Val Asp Gly Pro Asn
      165   170   175

Ala Ser His Ile Thr Pro Ser Ala Leu Asp Arg Trp Glu Lys Arg Leu
      180   185   190

Asp Asp Leu Phe Thr Gly Arg Pro Tyr Asp Met Leu Asp Ala Ala Leu
     195   200   205

Ser Asp Thr Ile Ser Lys Phe Pro Ile Asp Ile Gln Pro Phe Arg Asp
  210   215   220

Met Ile Glu Gly Met Arg Ser Asp Leu Arg Lys Thr Arg Tyr Lys Asn
225   230   235   240

Phe Asp Glu Leu Tyr Met Tyr Cys Tyr Tyr Val Ala Gly Thr Val Gly
     245   250   255

Leu Met Ser Val Pro Val Met Gly Ile Ala Pro Glu Ser Lys Ala Thr
     260   265   270

Thr Glu Ser Val Tyr Ser Ala Ala Leu Ala Leu Gly Ile Ala Asn Gln
     275   280   285

Leu Thr Asn Ile Leu Arg Asp Val Gly Glu Asp Ala Arg Arg Gly Arg
  290   295   300

Ile Tyr Leu Pro Gln Asp Glu Leu Ala Glu Ala Gly Leu Ser Asp Glu
305   310   315   320

Asp Ile Phe Asn Gly Val Val Thr Asn Lys Trp Arg Ser Phe Met Lys
     325   330   335

Arg Gln Ile Lys Arg Ala Arg Met Phe Phe Glu Glu Ala Glu Arg Gly
     340   345   350

Val Thr Glu Leu Ser Gln Ala Ser Arg Trp Pro Val Trp Ala Ser Leu
     355   360   365

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Leu Leu Tyr Arg Gln Ile Leu Asp Glu Ile Glu Ala Asn Asp Tyr Asn
    370               375               380
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Asn Phe Thr Lys Arg Ala Tyr Val Gly Lys Ala Lys Lys Leu Leu Ala
385               390               395               400
```

```
Leu Pro Val Ala Tyr Gly Arg Ser Leu Leu Met Pro Tyr Ser Leu Arg
                405               410               415
```

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Asn Ser Gln Lys
            420
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<210> 15

<211> 1260

<212> DNA

<213> Capsicum annuum

<400> 15

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tgcaatgaga gaatcaagag aggaggtgga aaacaaaggt ggagttttgg ttcttacttg   180

ggaggagcac aaactggaag tggacggaaa ttttctgtac gttctgctat cgtggctact   240

ccggctggag aaatgacgat gtcatcagaa cggatggtat atgatgtggt tttgaggcag   300

gcagccttgg tgaagagaca gctgagatcg accgatgagt tagatgtgaa gaaggatata   360

cctattccgg ggactttggg cttgttgagt gaagcatatg ataggtgtag tgaagtatgt   420

gcagagtacg caaagacgtt ttacttagga cgatgctaa tgactccgga gagaagaaag   480

gctatctggg caatatacgt atggtgcagg agaacagacg aacttgttga tggtccgaat   540

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agtggacggc catttgacat gctcgatgct gctttgtccg acacagtttc caaatttcca   660

gttgatattc agccattcag agatatgatt gaaggaatgc gtatggactt gaggaagtca   720

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ggagaagatg ccagaagagg aagagtctat ttgcctcaag atgaattagc acaggcaggt   960

ctatccgacg aagacatatt tgctggaaga gtgaccgata atggagaat cttcatgaag  1020

aaacaaattc agagggcaag aaagttcttt gacgaggcag agaaggagt gaccgaattg  1080
```

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agcgcagcta gtagatggcc tgtgttggca tctctgctgt tgtaccgcag gatactggac   1140

gagatcgaag ccaatgacta caacaacttc acaaagagag cttatgtgag caaaccaaag   1200

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<210> 16

<211> 1239

<212> DNA

<213> Lycopersicon esculentum

<400> 16

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tccaatgaga gaatcaatag aggtggtgga aagcaaacta ataatggacg gaaattttct   180

gtacggtctg ctattttggc tactccatct ggagaacgga cgatgacatc ggaacagatg   240

gtctatgatg tggttttgag gcaggcagcc ttggtgaaga ggcaactgag atctaccaat   300

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tcaaaggcaa caacagagag cgtatataat gctgctttgg ctctggggat cgcaaatcaa   840

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gataaatgga gaatctttat gaagaaacaa atacataggg caagaaagtt ctttgatgag   1020

gcagagaaag gcgtgacaga attgagctca gctagtagat tccctgtatg ggcatctttg   1080

gtcttgtacc gcaaaatact agatgagatt gaagccaatg actacaacaa cttcacaaag   1140

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cttgtgcctc ctacaaaaac tgcctctctt caaagataa   1239

<210> 17

<211> 891

<212> DNA

<213> Erwinia sp.

<400> 17

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cgcagcgtac tgatgctcta cgcctggtgc cgccattgtg acgatgttat tgacgatcag     120
acgctgggct ttcaggcccg gcagcctgcc ttacaaacgc ccgaacaacg tctgatgcaa     180
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cgtatcgccc gacgtttggt gcaggaagca gaaccttact atttgtctgc cacagccggc     660
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atgcgggctc atcctccccg ccctgcgcat ctctggcagc gcccgctcta g             891
```

<210> 18

<211> 1479

<212> DNA

<213> Erwinia sp.

<400> 18

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tatgtctacg aggatcaggg gtttaccttt gatgcaggcc cgacggttat caccgatccc     180
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ctgccggtta cgccgtttta ccgcctgtgt tgggagtcag ggaaggtctt taattacgat     300
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```

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actgtccctt ttttatcgtt cagagacatg cttcgcgccg cacctcaact ggcgaaactg    480

caggcatgga gaagcgttta cagtaaggtt gccagttaca tcgaagatga acatctgcgc    540

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tacctggtcg gcgcaggcac gcatcccggc gcaggcattc ctggcgtcat cggctcggca   1440

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<210> 19

<211> 1488

<212> DNA

<213> Erwinia sp.

<400> 19
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ggtcgggctt atgtctacga ggatcagggg tttacctttg atgcaggccc gacggttatc    180

accgatccca gtgccattga agaactgttt gcactggcag gaaaacagtt aaaagagtat    240

gtcgaactgc tgccggttac gccgttttac cgcctgtgtt gggagtcagg gaaggtcttt    300

aattacgata cgatcaaac ccggctcgaa gcgcagattc agcagtttaa tccccgcgat    360

gtcgaaggtt atcgtcagtt ctggactat tcacgcgcgg tgtttaaaga aggctatctg    420
```

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catctgcgcc aggcgttttc tttccactcg ctgttggtgg cggcaatcc cttcgccacc    600

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cagactaagc gcatgagtaa ctctctgttt gtgctctatt ttggtttgaa tcaccatcat    960

gatcagctcg cgcatcacac ggtttgtttc ggcccgcgtt accgcgagct gattgacgaa   1020

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actaatctct acctggtcgg cgcaggcacg catcccggcg caggcattcc tggcgtcatc   1440

ggctcggcaa aagcgacagc aggtttgatg ctggaggatc tgatttga   1488
```

<210> 20

<211> 839

<212> DNA

<213> Oryza sp.

<400> 20
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tattctgtag tacagacaaa actaaaagta atgaaagaag atgtggtgtt agaaaaggaa    120

acaatatcat gagtaatgtg tgagcattat gggaccacga aataaaaaga acattttgat    180

gagtcgtgta tcctcgatga gcctcaaaag ttctctcacc ccggataaga aacccttaag    240

caatgtgcaa agtttgcatt ctccactgac ataatgcaaa ataagatatc atcgatgaca    300

tagcaactca tgcatcatat catgcctctc tcaacctatt cattcctact catctacata    360

agtatcttca gctaaatgtt agaacataaa cccataagtc acgtttgatg agtattaggc    420
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gtgacacatg acaaatcaca gactcaagca agataaagca aaatgatgtg tacataaaac      480

tccagagcta tatgtcatat tgcaaaaaga ggagagctta taagacaagg catgactcac      540

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gcaaaagaaa gagagaaaga acaacacaat gctgcgtcaa ttatacatat ctgtatgtcc      660

atcattattc atccaccttt cgtgtaccac acttcatata tcatgagtca cttcatgtct      720

ggacattaac aaactctatc ttaacattta gatgcaagag cctttatctc actataaatg      780

cacgatgatt tctcattgtt tctcacaaaa agcattcagt tcattagtcc tacaacaac       839
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<210> 21

<211> 642

<212> DNA

<213> Oryza sp.

<400> 21
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attagatcaa tcctgcacta caagtagagt aaagtggtga tttctcttaa atctctcgaa      180

tggtgattta agaattcagt gcaaaccaaa tccttgctat aatcaaatgt tcggtaccgc      240

atcaacggaa caataaaaag cgcctggcgt accataattt tgtcattctt gttgaaattt      300

gtaatttaag atgcatgagg ccacacgacc ttaatgttca acgtgtcatg cattagtgaa      360

ataatagctc acaaaacgca acaaatatag ctagataacg gttgcaatcc ttaccaaact      420

aacgtataaa gtgagcgatg agtcatatca ttatctcccg cctgctaacc atcgtgtaca      480

ccatccgatc acaaaaatga caacttctag ggatgaacct ggacaaggtt tagggtttag      540

ggatgaatct ggacaaatga ttgttcaggt tcatccctag atgttggttt ctcctgacgg      600

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<210> 22

<211> 190

<212> DNA

<213> Artificial- INTRON

<400> 22
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```

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tattacatag ctttaactga taatctgatt actttatttc gtgtgtcttt gatcatcttg   180
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<210> 23
<211> 171
<212> DNA
<213> TRANSIT PEPTIDE

<400> 23
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<210> 24
<211> 254
<212> DNA
<213> NOS TERMINATOR

<400> 24
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atgacgttat ttatgagatg ggtttttatg attagagtcc cgcaattata catttaatac   180
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atgttactag atcg                                                     254
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<210> 25
<211> 193
<212> DNA
<213> CAMV 35S TERMINATOR REGION

<400> 25
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tcccagataa gggaattagg gttcttatag ggtttcgctc atgtgttgag catataagaa   120
acccttagta tgtatttgta tttgtaaaat acttctatca ataaaatttc taattcctaa   180
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aaccaaaatc cag   193

<210> 26

<211> 238

<212> DNA

<213> POTATO PROTEINASE INHIBITOR GENE TERMINATOR REGION

<400> 26
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ttactaatta tctgaataag agaaagagat catccatatt tcttatccta aatgaatgtc   180

acgtgtcttt ataattcttt gatgaaccag atgcatttta ttaaccaatt ccatatac   238

<210> 27

<211> 2321

<212> DNA

<213> Lycopersicon esculentum

<400> 27
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ttagtttgtt tatttataca gaattatacg cttttactag ttatagcatt cggtatcttt   180

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ctgtgccagg ttgtgaaccc tgtcggcctt acaaagatc cccaatagag gggtttttatt      1920

tagccggtga ctacacgaaa cagaaatact tggcttcaat ggaaggcgct gtcttatcag      1980

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tttttaatcc caagtttaaa tataaagcat attttatgta ccactttctt tatctggggt      2280

ttgtaatccc tttatatctt tatgcaatct ttacgttagt t                         2321
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<210> 28

<211> 1749

<212> DNA

<213> Capsicum annuum

<400> 28
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attgtacagg attacgagtt acttgttggc cggagccaga ggaagttggc agaaacaagt    1740

gtagtttag                                                           1749
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<210> 29

<211> 2264

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<212> DNA

<213> Zea mays

<400> 29

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gaaaactgaa caacacatat gaccaccttc ttttcagcag gagttcactt ttaagtgtct    1620

atgcagacat gtcagtaacc tgcaaggaat actatgaccc aaaccgttca atgctggagt    1680
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<210> 30

<211> 2027

<212> DNA

<213> Oryza sp.

<400> 30
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tgtcttaagg aataaaggaa aaagattccg tcggaggctc ggtgctctac aggttgtttg     180

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cttaaatgga atatgggcca tactaagaaa caatgaaatg ctaacttggc cagagaaggt     660

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<210> 31

<211> 1931

<212> DNA

<213> Lycopersicon esculentum

<400> 31

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<210> 32

<211> 1982

<212> DNA

<213> Capsicum annuum

<400> 32

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aagacgccag tggaaaattt ctttcttgct ggctcatata caaaacagga ctacatcgat      1620

agtatggaag gggcaactct ttcaggcaga caagcttctg catacatatg tgatgctgga      1680

gagcagctgt tggcgctgcg aaaaaagatt gctgctgctg agttaaacga gatctctaaa      1740

ggtgtatcgc tatcggatga gttgagtctt gtctgatgac tgcaaatcat tcagaaatat      1800

aattcagtta ggcagtgcat aaggaagaat cttctaaat ttttgagtct cacaattatg      1860
```

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gaaatcaaaa tatgttttaa aaatgttgta tgtatgtaat attagtaaat cttcatagtg    1920

atgtatgtat ctattctgcc acgcttcagt ttagtgaaat ggaacttatt gctgcatcaa    1980

tc                                                                   1982
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<210> 33

<211> 2265

<212> DNA

<213> Zea mays

<400> 33
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ccctgccacg acgcccgcga caaatccctg cgcgacggca tcttcgcctc ccatcccctc      60

ccagcttccc ctcccactcc ggccctcaca caaattgccc ctcttcttct cctcctcttt     120

acacgctgcc gaccacggct gccgccaacc acccgcccca cccgtccacc gctgccgagt     180

gctagccatt tggagctgcc gcgccatggc gtccgtggcc gccaccacca cgctggcacc     240

ggcactcgcc ccgcgccggg cgcggccagg gactgggctc gtgccgccgc gccgggcctc     300

ggccgtcgct gctcgctcga ccgtaacgtc tccgacatgg cgtcaacgct cccaaaggtt     360

attcccaccc gagccagagc actacagggg cccgaagctc aaggtggcca tcatagggggc    420

aggccttgcg ggcatgtcca ccgctgttga gctcttggac cagggccatg aggttgattt     480

gtacgagtcc cgtccgttta tcggtggcaa ggttggctcc tttgttgaca ggcaaggaaa     540

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gaagaaggtt ggcgctgata ataatctgct ggtgaaggaa catacccata ctttttgtaaa    660

taaaggggggc acgattggtg aacttgattt tcggttcccg gtgggagctc cgttacatgg     720

cattcaagca ttcctaagaa ctaatcagct caaggtttat gataaagcaa gaaatgcagt     780

tgctcttgcc cttagtccag ttgttcgggc tctggttgat cctgatggtg cattgcagca     840

agtgcgggac ttggatgata taagtttcag tgattggttc atgtccaaag ggggtactcg     900

ggagagtatc acaagaatgt gggatcctgt tcgttacgct ttgggtttca ttgactgtga     960

taatatcagt gcacgttgca tgcttactat tttcaccttg tttgccacaa agacagaggc    1020

atccctgtta cgcatgttaa agggttcacc tgatgtttac ttaagtggtc aataaagaa     1080

gtatataaca gacaggggtg gtaggtttca cttaaggtgg ggatgcagag aggttctcta    1140

tgagaagtca cctgatggag agacctatgt taagggcctt ctactcacca aggctacaag    1200

tagagagata atcaaagctg atgcatacgt cgcagcctgt gatgttccag gtatcaaaag    1260

attacttcca tcagaatgga gggagtggga aatgtttgac aatatctaca agttagatgg    1320

tgtccctgtt gtcactgtcc agctccgcta caacggatgg gtcactgaac ttcaagattt    1380
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ggagaaatca agacaactgc aaagggcggt tgggttggat aacctttgt acacggcgga      1440

tgcagacttt tcctgttttt cggaccttgc tctctcatct cctgctgatt actacattga      1500

agggcaaggt tccctgatcc aagctgtgct gactcctgga gatccataca tgccattgcc      1560

aaacgaggag atcattagta aggttcaaaa gcaggttgta gaactgttcc catcttcccg      1620

gggcttagaa gttacatggt ccagtgtggt aaagatcgga caatcgctgt accgtgaggc      1680

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actcatcgac gacggcgaga aggcgctggg gaacgttcaa gtcctgcagg ctagctgaac      1920

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tcaggcagtg tgtaagttca gctggaactc gattggtaat tgggatggat gattgatgat      2220

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<210> 34

<211> 1632

<212> DNA

<213> Oryza sp.

<400> 34
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aagaaatgcc gttgctcttg ctctaagccc agttgttcga gctcttgttg atccagatgg      180

tgcattgcag caagtacggg atttggatga tgtaagtttc agcgattggt tcttgtcgaa      240

aggtggtact cgagagagca tcacaaggat gtgggatcct gttgcctatg ctcttggttt      300

cattgactgt gataatatca gtgcacgttg catgcttacc attttcactc tgtttgccac      360

aaaaacagag gcatctttat tacgcatgct aaagggttca cctgatgttt atctgagtgg      420

tccaataaag aagtacataa cagacagggg tggtaggttt cacctgaggt ggggatgtag      480

ggaggttctc tatgataagt cacctgatgg ggaaacctat gttaaaggcc ttctcctatc      540

caaggctaca agtagagaga taatcaaagc agatgcatat gtcgcagctt gtgatgtccc      600
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ggggatcaaa agactttttac cttctgaatg gaggcaatgg gatacatttg acaacatcta      660

caagttagat ggtgttcctg tagtcacagt acagcttcgt tataatggat gggttacaga      720

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catgccattg ccgaatgagg agataattag caaggttcaa aagcaggtct tagaattgtt      960

cccgtcatca caaggcttgg aacttacatg gtcgagtgtg gtgaaaatcg gtcaatcatt     1020

gtaccgcgag tcaccaggaa atgatccatt tagacctgat caaaagacac cagttaaaaa     1080

cttcttcctg tctggctctt acacaaaaca ggactacatt gacagcatgg aaggggcaac     1140

tctctcaggc aggagaaccg cggcctacat ctgtggtgca ggagaggagc tgcttcgccc     1200

tccgaaagaa gctcattgtc gacgacagcg gagaaggcca ggggtaaggt cgacggccct     1260

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acttgattga gcatttaggt ccaatctgct gctgcccttt ttgccttgac acgatcgttc     1440

gttcgcccgt caatggtgtg ttcttcgtta ttgtgaattt gtgattggga accaaaggtg     1500

gcatacggga ttacatcagg cagcgtgtgt tttgttcagc ttaaccgatc attgaaccca     1560

ttgatgatga tgatgatgtt tatatagtgc acacatcact taaaaaaaaa aaaaaaaaaa     1620

aaaaaaaaaa aa                                                          1632
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<210> 35

<211> 40

<212> DNA

<213> PRIMER

<400> 35
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<210> 36

<211> 26

<212> DNA

<213> PRIMER

<400> 36
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ctgtccatgg cggccatcac gctcct                                            26
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<210> 37

<211> 40

<212> DNA

<213> PRIMER

<400> 37
cgatggcctg catggcccta ggtctggcca tttctcaatg   40

<210> 38

<211> 32

<212> DNA

<213> PRIMER

<400> 38
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